NUCLEAR PHYSICS

Hope To Detect Bomb Test

Study of radioactive clouds offers promise that American investigators may be able to detect the test explosion of an atom bomb in other parts of the world.

➤ IF SOVIET scientists have figured out a way to make atom bombs, would they be able to carry out the necessary single test explosion without our knowing it?

Assuming, as some Americans do, that the USSR will immediately attack the United States as soon as the Red Army has this most powerful of all weapons, Russian leaders would hardly be so reckless as to launch such a surprise assault without first making at least one test, just as we used up the first bomb built in the New Mexico test before we ventured to drop the next two on Hiroshima and Nagasaki.

This is because of the unique nature of the atom bomb. It does not explode because a primer and booster charge are fired in a mass of uranium 235 or plutonium. Atomic explosions take place when the amount of either of these fissionable elements in one chunk reaches a point where their spontaneous breakdown, or fission, produces neutrons sufficient to produce an almost instantaneous chain reaction. This spontaneously exploding quantity of the bomb element is called its critical mass.

An atom bomb is made by taking two chunks of uranium 235 or plutonium, each less than the critical mass, and suddenly thrusting them together into one mass that is above this critical explosion point. The mechanism of an atom bomb must therefore be quite different from that of an ordinary TNT bomb; and that is why the Russians would have to make a test if they succeeded in producing a bomb of their own.

They might do as we did during the war: make all preparations with the greatest secrecy, not tell anyone when or where the test was made, and trust that the effects could never be detected. But we had the advantage then of almost total unpreparedness by even our enemies for such a test. With all the world shivering in fear of the possibility of a new war, such relatively easy secrecy will not be attainable.

On the other hand, Russia diplomats and military men might attempt to run a colossal bluff: tell the world boldly that they possessed an atom bomb and had made the necessary test.

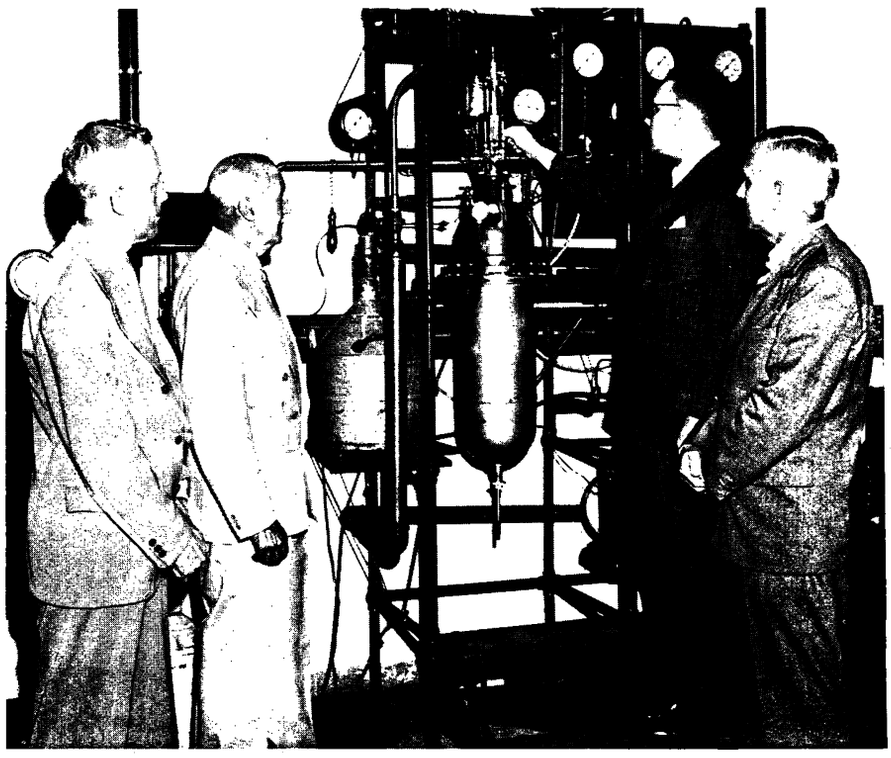
Is there any way for outsiders to get at the facts, in spite of the security precautions which the Soviet leaders could naturally be expected to take in their own interest?

Disregarding possible use of "orthodox" methods of espionage, what are the scientific methods that might be used to detect a test explosion of an atom-bomb a long way off?

Principal methods suggested are three: seismic, or check on the earthquake-like waves in the earth started by such a giant explosion; microbarographic, or detection of a pressure-wave in the air; radiometric, or spotting of the spreading cloud of atomic fragments by their electrical charges.

Least promising, probably, is the seismic method. True, the jar of the Alamogordo test was detected by a few earthquake observatories, but these were less than 300 miles away; more remote instruments, even in the United States, showed no trace of it. Neither did the underwater explosion at Bikini record itself on any seismographs except those especially installed on the atoll itself.

Use of the microbarograph, which is an instrument built to record exceedingly minute changes in air pressure, does not look much more promising. True again, such an instrument in England did record the fall of a great meteorite in Siberia in 1908. However, this immense missile from outer space released more destructive energy than a hundred or more atom bombs all at the same place in the same instant. If Soviet scientists were to explode a mere single atom bomb in the same place (which would be a pretty good one for the purpose) or in the deserts of southwestern Asia (which might be better) it is rather unlikely that its pressure-wave would be detectable by microbarographs outside the boundaries of the USSR.



LIQUID HELIUM MACHINE—Being examined in the Sloane Physics Laboratory at Yale, where temperatures approaching absolute zero have been reached, by, left to right: William W. Watson, chairman of the Yale Physics Department; President Charles Seymour of Yale; Cecil T. Lane, associate professor of physics in charge of liquid helium experimentation; and Edmund W. Sinnott, director of the Sheffield Scientific School and the University Division of Sciences.

That leaves the possibility of learning that an atom bomb explosion has taken place by electroscopes — highly sensitive instruments that can detect the impact of even one electrically charged particle, and would be certain to show the passing of a big cloud of them, such as made up much of the ominous mushroom-shaped clouds that rose over Alamogordo, Hiroshima, Nagasaki and Bikini.

These clouds dissipated, became invisibly thin; yet myriads of charged particles remained relatively close together, as compared with the sparse scattering of such particles that are normally present in the air all the time. The critical question is: Would the cloud still be thick enough, after drifting half-way around the world, to be recognized by these means?

Testimony is conflicting. After "Able" day at Bikini, the most nearly comparable test, so far as distance is concerned, several operators of such instruments, notably in California, Oklahoma and Texas, reported finding traces of the drifting charged cloud in their records. Other observers denied this; and their numbers included some of the world's leading physicists in parts of the world as widely separated as the United States, Peru and Australia.

There is one additional piece of negative evidence. In May, 1946, 40 days after the New Mexico test explosion, the Eastman Kodak Company had some X-ray film fogged by contact with strawboard that had become radioactive, presumably as a result of contamination by the northeastward-drifting cloud of atomic debris; either the straw used as raw material or the water used in processing had been affected. Carefully prepared "atom-traps" of cotton were exposed for 60 days after the first Bikini blast at various points in the United States and over the Pacific area as far out as Manila and Melbourne. Measurement of radioactivity "showed such low values as to be without definite significance as to dissemination of radioactive dust" from Bikini.

Distribution of the places where these tests were made, both electroscopic and photographic, was haphazard rather than scientifically planned. Observers simply checked up on their electroscopes wherever their laboratories happened to be; the cotton "atom-traps" were merely distributed to the principal Eastman branch offices, with instructions for their quite simple operation. If a systematic study had been undertaken of the possibility of recording a long-range drift of the radioactive cloud fragments, there would have been more observatories, preferably on mountaintops, on the Pacific coasts of North and South America, and probably some in the East Indies, the Philippines and Japan, but fewer at inland points.

Moreover, it is probable that for making a special test of the atmosphere, to find out if anybody has been setting off atom bombs secretly, a type of instrument somewhat different from existing electroscopes might be desirable. Certainly arrangements would be made to send lightweight instruments aloft by plane or free balloon, with robot radio sets to signal back to earth what they might find in the upper atmosphere.

If we want to sniff the stratospheric air for radioactive evidence of possible secret Soviet bomb tests, the likeliest places for high-altitude ground observatories, as well as for radio-robot balloon launching stations, would seem to be central and northern Japan, the Aleutians, and mainland Alaska. That is where winds blowing out of Russian Asia first flow over American-controlled land.

Would instruments so used tell of an atom-bomb explosion somewhere in interior Asia? On the basis of the conflicting evidence here reviewed, the answer cannot be better than "maybe." And if the U. S. Department of National Defense has better instruments and more advanced plans, naturally they aren't telling.

Science News Letter, October 25, 1947

CHEMISTRY

New Germ-Fighting Drugs

Scientists are beginning to understand "chemical kinetics," which promise to allow them to design and then to build substances that will block bacterial growth.

➤ NEW disease-fighting chemicals, tailor-made by scientists out of the cloth of more detailed knowledge of the structure of living matter, will result from the researches that Dr. Linus C. Pauling, California Institute of Technology chemist, described in his Silliman lecture at New Haven, Conn. as a part of the centennial of Yale's Sheffield Scientific School.

Whether a drug will successfully combat an invading germ is largely dependent upon whether the drug can be made more attractive to the germ than the living cell being attacked.

Dr. Pauling, digging into the matter of the molecules involved, finds that the antigen (the germ factor) and the antibody (the germ-fighting factor) interact with each other because they fit into each other in structure. A large portion of the surface of one can be brought into juxtaposition with the surface of the other molecule. Such closeness allows the weak forces operating between them to create an effective bond. Thus the drug can counteract the germ.

The exciting thing about this scientific research is that the scientists have the beginnings of knowledge of what is called "chemical kinetics" which promise to allow them to design and then to build chemical substances that will block the activities of bacterial and virus growth. Years may elapse between the fundamental research and the application to actual sick people but the way to success seems to have been found.

The nature of living matter itself is being better understood. Dr. Pauling explained that a substance called a catalytic enzyme allows the living cell to carry out any specific reactions that don't take place when the chemicals are just mixed together.

Bacteria are themselves living organisms and the scientific attack upon them is planned as an attempt to find a chemical molecule that will inhibit the particular enzyme that is necessary to growth of each kind of germ. This means that the chemists will have to build kinds of chemicals that resemble bacterial enzymes so closely that they join with them and put them out of business.

Disease fighting in a fundamental long-time sense has thus become a matter of delving into the molecular structure of substances, a research that at first blush might be considered far removed from curing the ill and fighting death.

Science News Letter, October 25, 1947

An alloy of iron and cerium is the so-called *flint* usually used in cigarette lighters.

In *muskrat farming,* ditches are sometimes dug in marshes to provide deeper water for the animals during winter weather; the ditches have no outlets.